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*Prof A. N. Waacke
with the regard
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A D D R E S S

DELIVERED BEFORE THE

N. Y. State Agricultural Society,

AT THE

ANNUAL MEETING, ALBANY, FEBRUARY 9, 1860.

BY

ABRAHAM B. CONGER.

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DELIVERED AT THE

ANNUAL MEETING

OF THE

N. Y. STATE AGRICULTURAL SOCIETY,

ALBANY, FEBRUARY 9, 1860,

BY ABRAHAM B. CONGER, PRESIDENT,

AND

ADDRESS OF BENJ. N. HUNTINGTON,

On taking the Chair as President elect.



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A D D R E S S .

Fellow Members of the New York State Agricultural Society :

In the year 1791, at the Senate Chamber in the city of New York, the Hon. John Sloss Hobart in the chair, certain rules and regulations were adopted for the governance of an association, to be known as "The Society for the Advancement of Agriculture, Manufactures and Arts." Two years thereafter, and about the time of the establishment of the Board of Agriculture of Great Britain, a charter was granted to the Society, by the Legislature of this State, in which it is a source of high satisfaction to us, to recount the names of the distinguished men of that age, the tutelary genii of an infant commonwealth, enrolled in long array as corporators in this institution, and ever to be remembered as the foremost promoters of Agricultural Art and Science. Those curious in such matters would not fail to notice the limitation in the act, imposed by the jealous care of the law-

makers of that day, but which from our present point of view, seems to have been specially pointed in irony, that the clear yearly value of the real and personal estate, which the Society might thereafter acquire, should not exceed the sum of eight hundred pounds.

The first annual oration before this Association, was delivered by the late Dr. Samuel L. Mitchell, then rising with rapid strides to the zenith of his fame, as a physician and philosopher, to which we allude, not so much for the purpose of rehearsing his doubts as to the beneficial action of quick lime on soils rich in vegetable matter, his chagrin that "plaster, so much extolled by the Pennsylvanians, had failed so egregiously on Long Island," or his recommendation for the introduction into this country of the tamed Buffalo of Europe as a beast of burden; but to accredit the clear and masterly manner in which he states the momentous question of artificial fertilization, and raises the inquiry whether much would ever be gained to our Agriculture from the introduction of the mangel-wurzel; questions still clamorous for an answer, and which have come down to us, bridging the span of nearly three-quarters of a century, fraught with a more imperious necessity for their solution.

This Society kept up a fitful existence, its names slightly variant under different charters which were granted, each for a limited term of years, until under the act of 1819, it received the cognomen of the Board of Agriculture, and was quickened into the exertion of a new but transient influence, by an appropriation of the sum of ten thousand dollars, which was mainly to be distributed among the County Societies. Provision was also made for the collecting and publishing of valuable information, in an annual volume to be distributed according to the wording of the statute among the good people of the State, the number however being limited to that of fifteen hundred. As long as the grants of Legislative aid were extended, these Societies maintained a prosperous appearance; but when denied, both parent and off-shoots dwindled and perished, as plants accustomed for a time to high and continued stimulus, when thrown upon the resources of their native sands.

But the good cause could not be overwhelmed by this general ruin, nor could the oblivious coldness of the powers that be, dishearten the friends of our profession. A few of the most zealous and enlightened of these came up to this Capitol, twenty-eight years ago, and instituted the Society

whose name we perpetuate. Their aim, as expressed in their circular letter, was to resuscitate, and mainly as before, to encourage and promote the organization of County and Local Societies of Agriculture and Horticulture. Their modest hope was, that they might be enabled to embody the wisdom of their time, as well as direct its yearnings after a clearer insight into the economy of nature, through the columns of a journal to be recognized as the organ of the Society. They solicited communications of "well attested experiments and facts," from the tillers of the soil then in best repute, and expressed the belief that the fund so to be collected could "not fail to enrich very greatly the community at large."

The leading spirit of this movement was one who, at a mature age, had retained the large enthusiasm of his native land. A Frenchman by birth, he was the owner of large estates in Jefferson county—Le Ray de Chaumont—who, on assuming the first presidency of this Society, vindicated its choice in his election, as he bore testimony to the fact, that he then represented the only county society which had survived the general wreck. But the master-worker in the new association was one who, like Franklin, was a printer by trade,

and had established, about the close of the last war, a newspaper in this city, for which he, for several years, maintained its claim as possessed of "an hundred eyes," while with constant vigilance and unclouded vision, he surveyed the political horizon of his day. After some years, vexed with the turmoil of the spirits he had summoned from the vasty deeps of political strife, he retired to pass the residue of his days on yonder hills, in practice and study, as a farmer. The reputation which he had thus gained, was soon merged into that more extended renown, acquired as the Corresponding Secretary of the Society, and the Editor of the Albany Cultivator, and his stores of learning, ever diffused and ever cumulating, treasured up in the pages of that journal, and inventoried with scientific skill in the treatises he subsequently published, have won for him a distinction so high, that he may be ever appropriately regarded as the Jethro Tull of American husbandry. Need I say in the presence of those who sympathized and assisted in his labors in the early up-building of this Society, that I seek to commemorate the virtues and the fame of the late Judge Buel.

By the methods I have indicated, and chiefly by that of maintaining its position as the patron of

the local associations, the Society was gradually obtaining the confidence and respect of the great body of our farming community, and was perfecting its scheme for a more thorough and extended usefulness, until it had fulfilled the novitiate prescribed by the satirist of the Sabine Farm, for the full development of all human conceptions and plans; and at its annual meeting, in 1841, expectant of the encouragement to be permanently offered through the munificence of the Legislature, it engrafted on its previous scheme of exhibitions of industrial products, (which you will bear in mind, were restricted to the limits of each county,) a plan which gave it reality and life, as a State institution. The resolution to hold annual fairs, in which the farming and manufacturing resources of the entire Commonwealth, might be represented, met with no dissenting voice, the Constitution of the Society was amended accordingly, and at once its unprecedented career of prosperity opened before it.

As we thus recall the time and occasion which ushered in for us such a series of signal successes, we may not be forgetful of those which were precursive of it, and when, in conformity with a usage sedulously cherished from the earliest days

of our Society, we are here convened to celebrate, under its present Constitution, its twentieth anniversary, we may be reminded that it is the twenty-ninth of the old style, and that we have for our assembling to-night, a sanction as grave and as authoritative as that which an unremitting service to the public welfare, paid by us for more than a quarter of a century, and by those who ministered before us for the half century preceding, can confer, and a memory and a fellowship, now growing ancient and venerable, claiming an older birth than that of the proudest of our Anglo-Saxon compeers, the Royal Agricultural Society of England.

And without boasting, we may add, that we possess a heritage as rich in the natural resources of farming wealth, a field for experiment and operation, as varied and as extended; have made with far less of patronage showered upon us, or the body of farmers we represent, achievements in practical skill and science, applied to our art as illustrious; command an influence as remotely felt, and as universally conceded throughout the civilized world; and enjoy a fame as bright and as enduring also, we trust, as theirs.

But time has not circled our name with his wreathed years, without exacting his tribute. His

last chaplet has not been added, ere he had gathered three of our most estimable associates ; one * who twenty years ago presided over our councils with his wonted benignity, and two others who actively participated in our labors and aspirations, the one † as Vice-President from the fifth district, and the other, ‡ charged with our fiscal cares for many years. It would be futile to attempt to measure the impulse given to our then uncertain destinies, by the calm courage and the trustful work of our venerable President, or to estimate the co-operative influence of those later associates, who now share his rest and honors. Good men ! brave and useful men ! their doings are written, and their memories will be embalmed in our chronicles.

But if lamentingly, we are constrained to cry out "The Fathers !" where are they ? it is not with a corresponding solicitude that we raise the inquiry, "the sons, the successors, where ? what are they ?" For here they are about us, responsive to our call, and in obedience to our behests, ready to take upon them their share in this great work, thoughtful alike of the memories and attainments of those who have gone before us, and sensitively alive to the responsibilities which cluster about their accession.

* Judge Van Bergen, of Coxsackie. † B. B. Kirtland, of Albany.

‡ Judge Turrill, of Oswego.

We stand now where, for a moment in our existence, our past and future seem, as by a spell from some magic wand, lapped in the embrace of the present. And if, while we review the work accomplished, and scrutinize with earnest and resolved gaze that which remains, to an observer outside of our circle it appeareth as a mere hallucination, and the wonder is passing strange that the inauguration ceremonies do not proceed, that the incoming administration seems to cling to that about to retire, as if loth to let it go; or that reversing the rule ordinarily adopted in the conduct of human affairs, that which is itself dissolving is tracing the path for that which is just assuming the direction of an executive trust; let him remember that under these forms of change the labor abideth, and is sustained as cheerfully in the humblest as in the foremost ranks; that whatsoever is prosecuted with success, is directed in its first steppings by a wise forecast, and that in the bonds of a fraternity constituted as ours, there is neither the aspiration for, nor the exercise of power.

Our Society sustains its beneficent relations to the community of farmers, and to the Agricultural world at large, under a twofold office. The one is annually fulfilled in its great exposition, where

its wealth of offerings is revealed for the instruction, and displayed to the admiring gaze of the million. The other is more equably administered through its Executive Board at the regular sessions, consisting partly in the maturing of its preparations for the first, but mostly in the consideration of methods best adapted for the discovery of new truths, or the rescue of the old from neglect and disuse, and for their proof and reduction to the necessities and contingencies of the farmer's life. Now, while it would be quite impossible to pass all or the greater part of these topics under review, within the limits prescribed for such an address, a few will be selected as bearing upon the business or material interests of our Society, and some theoretic views stated, some practical inferences suggested, touching questions of no light importance to Agricultural Science.

Our late Fair has received its full meed of praise which it is far from my purpose at this time to seek to enhance. As by general consent, there has been accorded to it, the credit of an unparalleled success, you will indulge me in saying, that my own personal recollections hinge principally upon its general and pervading harmony. A show, well balanced in all its proportions, with an arrange-

ment of the ground and location of structures, which expressed a long sought desideratum in our councils, it welcomed under a benignant sky, its throngs of exhibitors and judges, visitors and attendants, who participated in, and in turn cordially ministered to the general satisfaction and service. In fact, not only among our own people, but with guests from sister sovereignties, the feelings of delight manifested were unalloyed, save perchance by a sense of surprise at the extent and magnitude of our preparations, and their completeness in all their parts. But when I consider how nearly the serenity of our enjoyment was being marred by an outbreak which at one time it was feared might have become riotous, I cannot but advert to its cause as far, at least, as the limits of delicacy on such an occasion permit, in the hope that by attracting attention thereto, the Society may in future be relieved from any danger of its repetition. The lessees of certain booths erected near the main entrance to the Fair claimed the right of selling spirituous and fermented drinks in them, by a right anterior to the possession, as yielded to the Society, of the grounds, and not only so, but by removing some of the boards, which separated these booths from the inte-

rior of our enclosure, sought to make sale to persons within the same. This was not only contrary to the statutes of the State, but in contravention of the positive rules and the established usage of our Society, and threw upon it the necessity and expense of increasing its police for the enforcement of its regulations. There ensued, what I think I do not over-estimate, the risk of an imminent and deadly breach of the peace, which it was believed by those associated with me, was only prevented by the exercise of the powers granted to the officers of the Society, under a late statute. Now, while it may be easily conceded that the farmers of this State, who have so uniformly banished this perilous stuff—this deadly pest—of intoxicating drink from their farm service, have a right to be secured against its intrusion at their annual festive gatherings; I may further insist, and this is the point I especially desire to make, that the localities, through their committees and principal citizens, who from time to time may invite the Society to hold its Fair on the ground provided by them, should use every precaution against any infringement of the laws, or of public decency, and take also upon themselves every reasonable responsibility of securing through their local magistracy,

the summary punishment of offenders; and this as a matter of honorable courtesy to the officers of the Society, who coming in the midst of them as guests, should neither be detailed to the suppression of local disorders, or by contingency summoned as witnesses in any prosecution arising therefrom.

I urge, then, that the Society should receive ample local aid not only in the observance of the rules adopted for the rigid exclusion of intoxicating liquors as a beverage, from within the enclosures of its fair grounds, as well as the enforcement of the statutes of the State in all approaches to the same; but also in everything which militates against the public peace, or threatens the welfare or the lives of the thousands brought thither, who as the Society, may claim a hospitable protection and care.

On grounds of a like public morality, I may insist that the conditions in the bond and agreement given to the Society by the local committee in regard to the completion of all arrangements touching the Fair, and especially of the structures for the reception of cattle or goods to be exhibited, should receive a full compliance, and that by the day appointed. On no pretext of haste, or of excuse

for some improvidence, should the sound of the hammer ever be heard on the Sabbath, in the work of such erections, and if exhibitors do not make their entries within the time specified in the Society's poster, so as to give ample notice of any further accommodations required, they should expect no protection against their own indifference or heedlessness, which might involve, on the part of the Society, its officers or agents, a violation of the day of rest.

The policy of the Society, in regard to the rotation of its Fairs, is believed to be securely established. As the King's court of old, of which it was boasted that it brought justice to every man's door, so our Fairs bring the advanced knowledge of Agricultural and Mechanical improvements into the different neighborhoods of the State. And as it is their principal object to diffuse among our farmers the knowledge of our accumulating improvements as widely as possible, so it is necessary to gather about their exhibition the greatest number possible of our Agricultural population. I therefore recommend, that in future our railroad and other companies engaged in the transportation of persons, be solicited to issue as in former years, to those attending our Fairs,

excursion tickets. These have heretofore induced many to visit our exhibitions, who otherwise would have remained at home, and will not only increase the receipts of these companies, but also those of the Society. And this last is a consideration of no light importance to its future and permanent interests. Though so long established, it has accumulated nothing, and owing to the large expenditures at our late Fair, principally those connected with the Police Department, the surplus left from receipts, greater than ever before, will be, beyond expectation, light. But it is hoped that with economy judiciously administered, and in the observance of those prudential measures previously indicated, which will lighten the burden of protecting the property of exhibitors, and maintaining the public order, the Society will, by increasing its annual receipts, be able to lay aside not only enough to make up the deficiencies of an unfavorable Fair, which has heretofore been its highest financial aspiration, but a sum whose interest alone will be sufficient to protect it against any such disasters. I know it has many excellent friends who have thought that sound policy required that it should amass nothing except at intervals, but I believe that on reflecting upon the financial condition

of our Commonwealth as it may possibly exist not many years hence, they will yet conclude that it would be wise to place this Society in a position so independent of Legislative or extrinsic aid, that it may nowise be cumbered in its beneficent operations, and that its premiums in money and plate may rank with those offered by any Society in the Union, and may then in general estimation be of a value co-ordinate with that heretofore universally conceded to its diploma.

If the brief outline of the early history of our Society, which I attempted at the opening of this Address, is not without its interest to those pleased with antiquarian researches, it is also not without a valuable lesson to us, and to all associated in the advancement of Agricultural pursuits. It has, I trust, with reference to the influence of Societies constituted as ours, demonstrated satisfactorily the importance of Fairs, and that without these they could maintain only a brief and chequered existence. Whether annually or biennially or at longer interval, these exhibitions serve to keep alive the connection of our Societies with the great body of the people, and to give palpable proof that their interests are identical with ours. The suggestion, it is true, has been brought forward in

certain quarters, that a Society representing an extended interest, might exist as a bureau of Agriculture, but it could only maintain its being by governmental patronage or immense endowments, and then it would be a most arduous task to diffuse its influence or establish its relation with the masses it sought to benefit.

Our Society has an abiding, a *home* interest in the work of speeding the plow within the limits of our own State, and of arresting and furnishing the sufficient corrective for that alarming deterioration in our Agricultural products, as observed by the census reports from 1845 to 1850, and still believe not to have entirely ceased. I had intended to draw your attention to some of these items of diminished production in detail, and to reiterate the assurances submitted by a late President,* for a more energetic and thorough tillage, as furnished in the superiority of our home markets over those of the great west, with reference to the transit to our Commercial Emporium of cereal products for foreign consumption; which in a natural state of things, represents the interest of at least fifty dollars per acre, as the advantage which every tillable acre of our State has over any lying west of the lakes, facilities of trans-

* Judge Cheever, in his annual address for 1855.

portation to the great routes of travel being equal; but the vexed discussion in other quarters of topics intimately connected with this, forbid any more explicit allusion to it.

I may, however, say in reference to this subject of diminished production, that it was with no little interest I marked the great sensation produced at the opening of our session, in the reading of the report of the Executive Committee, who reviewed the alarming statistics from the Agricultural Report of the State of Ohio of the destruction of sheep—one-eighth of a million in number—in the previous year, and that by marauding kennels of dogs. Such a statement is well calculated to send a shudder through the breast of any disposed to the study and practice of a true economy; but fearful as these figures are, they are but the shadow of those which ascertained, as by the census previously referred to, the dwindled sheep-flocks of the farmers of this State.

Three millions of sheep in five years, or at the rate of six hundred thousand per annum, is the story of their thinning out, and though it may be insisted that but a fraction of this number was taken off by unleashed whelps, yet it cannot be concealed that their incursions lie at the basis of

the discouragement and decline of this husbandry. Knowing that it is the most profitable branch of feeding which the farmer has, whether for quick returns of moneys invested, or for the manurial wealth accumulated in the fold, and that in connection with root-culture, it is the main hope we possess for the restoration of our soils, even to its ancient standard of productiveness, it is quite unaccountable, that such supineness on this subject, is manifested by the representative farmers in our Legislative Hall. Interests that might be indicated commercially by millions of dollars, and agriculturally in the facilities afforded for a higher tillage and a maximum yield, by as many millions more, are not only jeopardized, but wholly disregarded; as if the howl of curs was more grateful than the bleating of flocks, and the design of improvident legislation by an inefficient tax, was to let these disturbers of the night and burglars of the farm-yard, pass yet a little longer unwhipt, or pardon me for saying, unhung of justice.

I shall draw but briefly on your patience in noticing the last of those topics, affecting directly the outward material interests of the farmer which I purposed to review, the subject of steam-culture. This has engaged the serious consideration of our

Society, and commanded its highest premiums. I may safely speak the general sentiment of our Board, when I say that in a mechanical point of view, the ponderous instruments heretofore brought forward, are as averse to our system of tillage and our wants, as the massive unwieldy implements of husbandry projected and in use in the old world at least a quarter of a century ago, if not more so; and that in a scientific point of view, the turning over of furrows is not a desideratum, as the later researches of our chemists prove that what we need, is the thorough commingling of the particles of the soil, so that in the chemical play between them when brought newly together, the mineral food of the plant may be best supplied.

This admixture and juxtaposition we now best attain by spade husbandry, and this should be imitated, if not improved upon, in any new mechanical contrivance for the application of steam to the comminution and deepening of soil, by a rapidly rotating motion, instead of a slow uplifting overturning movement. On this subject nothing can be added for the guidance of our mechanicians to the clear and comprehensive statement presented by my able and illustrious predecessor.*

*Judge McCoun, in the Address of 1859.

But let me pass to the other themes proposed, more congenial to the taste of such as study nature in those various moods in which she hides herself from the untutored eye. As briefly as may be consistent with their due presentation, I will offer some considerations on the physiological laws, which promote the growth, and maintain the vital functions of plants, and which seem to be expressed in the selection and assimilation of their food.

I may bespeak, then, your especial attention, while essaying to bring to your notice a theory in regard to the motion of fluids in plants, first propounded more than a century and a quarter ago, and which has lain comparatively dormant, until restored about ten years since, to the arena of scientific thought, by the illustrious sage of Munich. In the year 1727, Stephen Hales, a Kentishman by birth, and a clergyman by profession, published a treatise, entitled "Vegetable Statics," in which, by methods of observation and induction, applied with eminent success, he demonstrated that the motion of the juices of plants, could not be accounted for by the forces of capillary attraction, but was maintained and might be measured by the evaporation going on from their surfaces above the ground.

Starting with the premise that men would discern more of that regular and orderly economy, which the Divine Architect has impressed on all the works of his hands, in the use of the faculties by which they are enabled to “number, weigh and measure” those parts of the creation which come within their observation; he proceeded in a series of carefully conducted experiments, so to measure and weigh the appropriation as well as the elimination of fluids by plants of various kinds, that by comparing the results so obtained, he was able to deduce certain general laws, which coming down to us from the age of Newton, re-prove most of the subsequent investigations into the laws of vegetable physiology, by the evidence they furnish of a more masterly method.

In the first experiment, conducted with a sunflower of three and a half feet in height, to ascertain the quantity imbibed and perspired by it within stated times, he found the mean rate of perspiration in twelve hours of a warm dry day, from July to August, to be twenty ounces, or thirty-four cubic inches of water; and that perspired during a dry warm night, without any sensible dew, to be about three ounces; while if the dew was barely perceptible, the perspiration was

nothing, or if heavy, or its precipitation was increased by rain, the plant and the pot in which it was contained, were increased in weight. By a very ingenious process, he measured the leaf surface of the plant, which he found to be over fifty-six hundred square inches, and by a like method, determined the absorbent surface of the periphery of the roots to be nearly twenty-three hundred square inches; so that the proportion of the leaf surface to that of the roots, was as five to two, a proportion which also expressed the ratio of the velocity with which water entered the surface of the roots, to supply the expenditure of perspiration, to the velocity with which the sap perspired. The area of the transverse cut of the middle of the stem being a square inch, if it were entirely hollow, the velocity with which the fluid passed through it, would be expressed by 34 to 12, the number of its cubic inches and of hours occupied in its transmission, but inasmuch as the stem, when dried, was found to waste three parts of its entire weight, its woody fibre was believed to fill up, at least, one-fourth of its area, and thus, the ratio of such velocity would be increased one-third, and stand as $45\frac{1}{3}$ to 12. But, if as suggested, in his third experiment with a vine, the sap rises

under the action of the heat of the sun, in a vapory form, this ratio may be increased tenfold, and stand as 37 to 1. Comparing the perspiratory surface of this plant, which weighed only three pounds, with that of a healthy man weighing one hundred and sixty pounds, he found that it was two and a half times greater ; that the plant transpired seventeen times more bulk of food, though only two-sevenths in weight, and that the rateⁿ of perspiration for equal surfaces and equal times, was as between the man and the plant, as ten to three. This great excess in the man, being accounted for by the greater heat of his skin than that of the plant surface, the query is raised, whether the sum of the areas of the pores lying in equal surfaces in the man and sunflower, must not be as sixteen to one, and the conclusion is hinted at as probable, that many of the distempers to which plants are subject, are owing, as in the case of animals, to a stoppage of their perspiratory functions by an inclement atmosphere. I have been the more willing to give this abstract, in order that not only the method with which Hales started, but the manner in which he applied it in this and all his experiments, might be appreciated, and serve as a guide to any future investigation of this kind,

which, with the more delicate instruments possessed by us, would, no doubt, render the expression of these numerical ratios more exact.

Noticing only at present in the intermediate experiments made with plants of the most diverse characteristics, the fixed relations in each plant between the root and leaf surface, which makes necessary the reduction of the latter by lopping off branches in transplanting, unless this is so carefully done as not to cut off any of the delicate fibres of the roots; also, that the leaves of evergreens have a less capacity for evaporation than those of deciduous trees; and also that fruit has an exhaling power proportionate to its surface, as compared with that of the leaves, we rest for a moment, at the 10th and 11th experiments, by which the evaporative power of the leaf surface is more clearly exhibited, and from which the conclusion is drawn, that the motion of the sap is at least in its proximate cause principally dependent on this power.

Hales took an apple branch, three feet long, and one-half inch in diameter, full of leaves and lateral shoots, and to it hermetically fastened a tube seven feet long and five-eighths of an inch in diameter, and having filled the tube with water, he

immersed the branch completely in a vessel of sufficient capacity and full of water. On the third day in the morning, the branch was taken out, and hung, with the tube affixed and newly filled, in the open air. The results were carefully noted as also those of similar experiments at different times, by which he was enabled to see how little was perspired, in a rainy day or when there were no leaves on the branches. In comparing these results, we find that the water was imbibed and exhaled by the branch with the leaves on and in the open air, with a velocity nearly one hundred times greater than when it was submerged in the water. Having cut off a branch similarly connected with a tube, thirteen inches below the same, it was placed in a vessel having a known quantity of water in it, and it resulted that in thirty hours it absorbed three times as much as was forced through the grosser part of the stem, fastened to the tube by the constant pressure of a column of water seven feet in height.

In his twenty-first experiment, at a period of considerable drouth, he laid bare the root of a thriving pear tree, digging down to the depth of two and a half feet, and having cut it off, he cemented the stump which was one-half inch in

diameter, to a glass tube, ^{and this} ~~which~~ having filled with water, he immersed in a cistern of mercury. In six minutes the root had imbibed the water with so much vigor, that the mercury rose in the tube eight inches, which corresponded to a column of water nine feet in height, and was found by Hales, in his later hæmastatical researches, to be nearly equal to the force with which the blood moves in the large femoral arteries, or even the carotids of the horse, and one and a half times greater than in the like currents of a sheep or a dog. In this, as in subsequent experiments, he found that the height to which the mercury rose, depended upon the heat of the sun communicated to the leaves and stem, and upon the hygrometric condition of the atmosphere; that the absorbent force was diminished by any injury to the plant, and was greater in a fresh cutting, whether of root or of branch, than in one exposed to water or air for any length of time; that this force was not necessarily dependent upon the vessels in the inner or outer bark, for when these were entirely cut away the leaves and twigs still absorbed and evaporated water through the residue of the stem; and that the measure of the force as given in his experiments should be increased about one-third, inas-

much as he discovered that the absorbent power was diminished by the expulsion of particles of air from the plant into the tube into which it was cemented.

It is highly probable that this gas was oxygen liberated by the action of sun-light from carbonic-acid gas, which, as recent investigations in vegetable physiology prove, is formed in every portion of a vegetable structure—as well that encased in the soil as that surrounded by the atmosphere—and of course implies a power in the evolution of this gas, as of pressure against the walls of the cells in which it is formed. This power acting in conjunction with the evaporation of watery particles from the surface, giving rise to a partial vacuum in all the vessels of a plant near the same, is thus accelerated by the pressure of the external air, and both when in play are constantly operating, the latter as the paramount force in the propulsion of the fluid contents of every plant, from its absorbent to its eliminating surfaces.

One of the most practical applications which Hales made of these conclusions, was in explication of the causes of the hop-blight. In the year 1723, he says, “when ten or fourteen days’ almost continual rains fell about the latter half of July,

after four months' dry weather," the most promising vines "were all infected with mold or fen in their leaves and fruit, while the then poor and unpromising hops escaped and produced plenty." As confirmatory proof of the views he presents on this subject, he further says, "this rain on the then warm earth made the grass shoot out as fast as if it were in a hotbed, and the apples grew so precipitately, that they were of a very flashy constitution, so as to rot more remarkably than had ever been remembered." Hales had in his ninth experiment shown the wonderful power of absorption of water, which the hop-vine possessed, and had calculated that the amount consumed in every twelve hours' day, independent of what passed from the surface of the earth, were for every acre "an area of liquor as broad as an acre and one one-hundred and first ($\frac{1}{101}$) part of an inch deep."

When, then, with such enormous power of absorption (a constitutional peculiarity of this and most annual plants), the atmosphere was itself heavily laden with moisture, the power of throwing off the fluids taken up so rapidly was checked, "the kindly perspiration of the leaves" was hindered, and the sap stagnated and speedily corrupted, as he has shown when condensing

perspiratory vapor in glass retorts to be readily effected. On like principles he accounted for the fire-blast, the explanation being similar to that which gardeners have formed into a practical rule, when they avoid putting their bell-glasses over their cauliflowers early in a frosty morning, before the dew was evaporated off them.

Hales had observed the vines in the middle of a hop ground all scorched up, when a "hot gleam of sunshine has come immediately after a shower of rain; at which time the vapors are often seen with a naked eye, but especially with reflecting telescopes, to ascend plentifully," and there being no "dry gravelly vein in the ground along the course of this scorch," the vapors forming a dense medium acted as lenses over the surface of each plant, and so by wilting it and contracting its pores deprived it of its evaporating power. From these experiments and deductions of Hales, you may readily apprehend the conditions under which plants can maintain a healthy condition; you at once infer the necessity of drainage for the purpose of removing too large a supply of fluids from the roots as well as of absorbing a temporary excess in sudden showers; that mold or fen fungi or excrescences indicate an abnormal supply or circu-

lation, and that a sudden loss of vitality in plants proves a "suppressed transpiration" of their fluids.

It was reserved for the quick eye of a Liebig to make application of these views to a just theory of the potato rot, which he says has been known to the oldest peasants from their youth, and was accurately described by Parmentier, who introduced this esculent into France; and if the physiological inferences of Hales are applicable, then the remedy for this terrible disease must be sought in the conditions necessary for the avoidance of either a vehement blasting or of a stagnation of the pabulous currents in the plant. As by the gradual removal of our forests and the exposure of large undrained surfaces to the action of winds and summer heat, we are liable to be visited with sudden showers during the time of the maturation of this root, followed immediately by the fierce blaze of the caloric beams of an almost meridian sun, it will be necessary, not only to secure thoroughly drained land for the cultivation of this crop, so that these hasty showers may be mostly drunk up by the warm and aerated earth, and no considerable portion of them be converted into vapor, which may invest the plants as with mirrors to refract the parching rays upon them, or which

may by a process of suffocation concentrate their juices in the cells and so ensure decay; but as we venture to suggest, to plant this crop in alternate rows with some other crop, having a greater capacity for absorbing moisture, or for resisting the process of suppression of the respiratory function, or the scorching power of sun-light, and furnishing withal a shelter from this last under its shadow. It is believed that the Indian corn or sorghum might prove efficient in this manner; at any rate the trial with these or other intermediate plants should be carefully made. It may be as in the interstitial fallows of the Lois-Weedon husbandry, so much vaunted for productiveness by its inventor, that a more thorough ventilation of the crop may be effected, tending to lift stagnating currents of vapor, as well as heavier dews secured, by presenting surfaces of unequal capacities for absorbing heat.

It will suffice in order to prove the general law, as asserted by Hales, of the causes which govern the motion of the fluids of plants, to allude to what might seem to be an exception to the general rule, the rise of sap or saccharine juices in the vine, the maple or birch trees and the like, before the leaves are fully developed.

In his thirteenth to his fifteenth experiments, Hales tested the power of capillary sap vessels in various ways. He showed that a cylindrical section of a vine as well as of an apple branch, when placed in water, continued for some days to exude a moisture from its upper surface, but could not raise any appreciable column of water, and repeating this experiment on a tree which he had cut off two and a half feet from the ground, separating it, by this act, from all its twigs and leaves, obtained the like result, which was not varied when he dug up the trunk with its roots and placed them in a vessel of water. But had the leaves been spared, the result would have been wholly different, whether as previously shown the section, the upper part of the tree, or the tree itself had been placed in water; or whether the bark had been removed inner or outer, or both, in whole or in part as far as immersed in the water; or whether, as also appeared, the section or branch had imbibed the water in the natural way from the greater to the less end or *vice versa*. In his sixteenth experiment he satisfied himself that, contrary to received impressions, sap rose in the winter although in comparatively inappreciable quantities, as he found that cuttings of filbert suckers,

vine branches and of some evergreen plants, when the transverse cuts were dipped in melted cement, "so as to prevent any moisture evaporating through the wounds," lost in weight, during an average period of eight days, from the one twenty-fourth to the one-third part of their weight, a waste which may be regarded as the index of the insensible perspiration they would have undergone had they remained in their natural connections. It is quite remarkable that it was the vine cutting that had lost the least, but the wonder subsides when we learn more of the idiosyncrasies of this plant. In the thirty-ninth experiment a vine stem which exhibited no indication of being expanded or contracted by heat or cold, in the bleeding or in the non-bleeding season, was affected by outward moisture, showing, as Hales says, "that the sap (even in its bleeding season) is confined in its proper vessels, and then it does not confusedly pervade every interstice of the stem as the rain does, which entering at the perspiring pores, soaks into the interstices and thereby dilates the stem." Supposing then by a peculiarity which makes the sap in the vine and in all bleeding trees to flow at certain seasons in larger quantities than are observed in other plants, it rises to seek its natural

perspiration at the points in the outer bark where the leaves are in embryo, and as these are being developed the insensible passes into a more copious transpiration; we can understand why it is that when the trunk is completely severed near the root, during this flow, the copious current is neither arrested nor absorbed by the little that is left of the perspiratory medium, but is exuded until arrested by the care of the vine-dresser, or death ensues from exhaustion.

The different phenomena observed principally during the bleeding season, as following the section of thriving shoots, or the entire severance of the stem, are stated in the thirty-fourth to thirty-eighth experiments. In the latter case the mercury rose from fourteen as high as thirty-eight inches, while in the case of three branches of the same vine, cut at different lengths and at various heights from the ground, the several columns ranged from twelve to twenty-six inches; the same general law as to the manifestation of the favoring influences of warmth and a dry atmosphere in the evaporative surface being fulfilled, and undulations also noticed as verifying the difference between an imbibing and a pulsive force.

Having observed "that in very hot weather many air bubbles would rise so as to make froth an inch deep, on the top of the sap in the tube," Hales affixed a small air pump to the top of a long tube, which had twelve feet height of sap in it, and he says "when I pumped, great plenty of bubbles arose, though the sap did not rise, but fall a little after I had done pumping." Hales supposed that these bubbles were composed of atmospheric air drawn in through the roots, but late analyses have determined their true nature, and have also explained more satisfactorily what Hales ascribed to a general attractive force, which he supposed to reside in all the parts of vegetable organisms. We now know that the sap of the vine is very rich in carbonic acid, and that this is readily disengaged at a moderate temperature by the fermenting action of the nitrogenous contents or lining of the cells, on the saccharine particles of the sap, and we may conclude that its great vernal flow is in the main to be measured by the tensive power of the carbonic-acid gas, when being disengaged in the cells of the plant, and operating upwards against a partial or entire vacuum, unless when all the branches are cut off, and then simply against the weight of the atmosphere.

It was when this gas was removed from the column of sap by the air-pump that the sap fell. And when as the development of the shoots commences, "and the surface of the vine is greatly increased and enlarged by the expansion of several leaves, whereby the perspiration is much increased and the sap more plentifully exhausted, it then ceases to flow in a visible manner."

But I may not further dilate. If this attempt to bring to the notice of our farming community, the views of this admirable thinker on this great fundamental law of the vegetable economy, seem too elaborate, my apology must be found in the desire to present them in such a way as not merely to attract attention to them, but to excite to observations and a thoughtful study after the same exemplar.

It is difficult to realize the fact that a man universally acknowledged as one of the brightest ornaments of the Royal Society during the eighteenth century, whose inventive talents planned ventilation for hospitals and prisons—whose benevolence, not manifest alone in parochial duties, distinguished him as an apostle of temperance for his times, and whose "Statics" was honored in its introduction to the savans of France by one of

no less eminence than the Count de Buffon, should in this age for himself or his discoveries in vegetable physiology rarely receive mention in the standard treatises on that subject. In such a state of things it is not so wonderful that a century after Hales had explored the sources of the vital movement in plants, Dutrochet should claim as its immediate cause, a force residing in structures named spongioles and supposed to be found in the extremities of the radical fibre. Groping in the dark, he conjured up for these a factitious existence and an imaginary function, and on such a basis reared his theory. The earnest student will not be perplexed by the opposition which ever and anon science receives from those who profess to be her votaries, or by the tardy progress she makes in the mastery of her true domain, when he calls to mind the inveterate obstinacy with which the classmen of the schools adhere to their complicated devices for unveiling the mysteries of nature, when he remembers that the *Principia* was a sealed book to the great body of mathematical scholars for more than two generations ; or when he notices in our day, since the theory of the respiratory process has been announced, by which we know that the supply of animal heat is derived from the

combustion of carbon in the oxygen inhaled at every breath, that attempts have been made to sustain the doctrine of a "balance in organic nature" by promulgating the idea that plants, as the "recipients of the power of the sun-beam," "transfer this power to the animal;" and that when consumed in the animal, the power so transferred is "expended in building up the organization, in producing locomotion and the incipient action of the heart," &c., and is returned by the animal to "celestial space, whence it emanated."

To such fanciful notions we may oppose the simple teaching of the philosophy which has explained the notion of fluids in plants, and which by a careful induction, may open the path of discovery to us of the efficient cause of the circulation of the blood in animals. At any rate, we may not rest upon any notion of the imprisoned sunbeams, nor, as more generally taught, of the automatic power of the red corpuscles, of capillary action, of the rhythmical propulsion of arterial currents, nor even upon the contractile movements of the heart, or the nervous force of the brain; for we know that whenever the whole stress of the animal economy is thrown upon either of these, as when

the perspiratory function is checked, or respiration impeded, or the waste-valves—if I may so speak of any internal organs—are closed, then their unnatural efforts, soon rendered convulsive, are speedily terminated in death. And I may be permitted to add, that if any mind is led to search after a more extended arena, for the operation of the evaporative force, as if the inquiry were raised whether this is not the display of some universal law in Nature, he may find such an investigation quite prepared for him in those matchless tracings of the atmospheric currents, brought to their present perfection by the indefatigable labors of gentlemen connected with our Coast Survey, and the Smithsonian Institution. In the viewless drift of the upper air, far above the sheen and tracery of the clouds, he may discern the surging of the void expanse, whose mighty whirl knows yet a law, and swaying the lower currents by its stately progression, appoints their course, disperses their stagnant columns, and quickens their loitering march. And if he, to whose mind this perpetual unrest of the aerial sea is not wholly a novelty, is disposed to admit the influence it may exert in relieving organic existences, whether vegetable or animal, from the suffocating pressure or deadly

taint of vapory masses, or malarious miasms, yet is unable to perceive what further benefit the mobile circulation of the ambient air may confer upon his material interests, or those of the farmers about him, he will learn how the fertilizing gases unspent in the service of vegetable life, whether near the poles or the equator, are wafted in perpetual cycles, concentrated in dews and rain, laving the hill and mountain sides, or precipitated upon arid levels; and in all that garden-belt of America, through which the Father of waters urges his mighty floods till they are lost in the hoarse murmurings of the Atlantic surf, unchecked by the Alleghanies, they ride bravely on and greet with their choicest treasures, the bosom of his own Empire State.

We have seen how necessary it is, in order to secure the normal healthful state of plants, that attention be paid to the balance between the receptivity of the atmosphere into which they respire, and the vigor they possess of absorbing and assimilating the elements of their nutrition. The wise husbandman postulates for the general purposes of his thrift, that the former is at the regular season of seed time and growth a constant quantity, and so directs his most careful study to

the latter, which he seeks to promote, by neither withholding the supply requisite for full development, nor by furnishing in excess food either inappropriate in kind, or profuse in measure. To know that the different plants we cultivate, require different kinds and quantities of food, for their perfect growth, leads at once to the inquiry, what are these various elements of nutrition, and to what soils, for what plants, and in what proportions are they to be applied. Our Agricultural Chemists have for the solution of these questions, entered upon researches more intricate in their details of analysis, than any ever before proposed to the physical philosopher, and they deserve and will, I am confident, receive the lasting gratitude of all thoughtful tillers of the soil. They have revealed to us, what elements of plant food are derived from the atmosphere, and what from the soil. It is true the conclusions of fact and theory as attained by different investigators are not always the same. The humus theory has been exploded, the nitrogen theory is on the wane, and the mineral theory is fast gaining celebrity. But this indicates only to the reflective mind, that the veins of inquiry in these several directions have been or are in their turn soon to be exhausted.

The farmer is not to infer that the humus in his peaty deposits or in the decaying leaves of his forests, or the ammonia yielded in his manure heaps or supplied in the markets, are to be considered valueless, when compared with phosphatic, siliceous or calcareous applications. Far from it. But he may know, and it would be wisdom for him to know, that by possibility he may have the two former in excess or in disproportion to the other necessary elements of plant food. If the humus theory has been exploded, it is simply because we have discovered that humus is far from being the only supply of carbonaceous material, it having been taught us that the atmosphere yields the greater part of the supply; but it is none the less desirable to acquire the intelligence, that with lime added to it and, in some cases, silicic acid, the potash, which is the principal mineral ingredient of humus, is liberated for the food of the plant. So with regard to nitrogen, if supplied too largely in ammoniacal form, it is found to be injurious or destructive; yet the discovery has been made that the soil has a power of absorbing it, in almost miraculous proportion, the statement of which, in numbers, I will not draw upon your faith to honor, and leaves us upon the

threshold of a problem, as yet insoluble, how best this almost fabulous charm may be broken, by which so many volumes of a gaseous body are absorbed and kept in ward by the merest atoms of soil.

It has been currently believed, by vegetable physiologists, that plants took up their mineral food in solution; but Liebig has almost placed upon this notion the ban of a delusion, by putting forth the doctrine that plants may absorb their food, in atomic quantities, without the presence of water. It is believed that researches in this country, by one formerly a pupil of his, may lead to the correction of the views entertained by the illustrious teacher. We learn, from other sources, that the specific gravity of the sap of the vine has been found to exceed, by eight or nine ten-thousandths parts, that of distilled water; also from experiments made in England, that the wheat and pea plants, absorb from every one hundred thousand grains of water, only thirty-two and thirty-nine grains of mineral food respectively. While scientific men differ as to the details of these researches, and have based upon the facts accepted by them, individually, different theories; while the unlearned world have received some of their announcements

with hootings of contempt, answered, not unfrequently, by tones far from conciliatory; it is a pleasant reflection for us that, at the present time, the feelings of antipathy between the scholarly and the practical agriculturists are allayed; that concessions of error have been made on either side, and that the extremes are closing in solid phalanx for the investment of the common objects of their search—*facts*, TRUTH.

And if any shall be encouraged to hope better things in the future of the mastery of their profession, or have resolved themselves to assist in the attainment of this glorious end—to be patient, studious observers of the workings of nature in her several economies of life, or to seek to catch, upon the mirrors which science furnishes, the rays which may illuminate paths yet adumbrated—every object proposed and every hope cherished in the remarks I have had the honor to submit, will have been attained and gratified.

Gentlemen of the Society, we sustain, in fellowship, important functions to the Institution in whose office and duties we are associated, to our brother farmers, whose labor and measure of prosperity we share, and to the commonwealth whose vast interests so momentarily depend on our assiduity and toil.

Our State stands in the very gates of commerce ; Science brings her countless treasures, and Art prepares the caskets for their bestowment and use. Earth and sky profusely cast about food for grass, herb and tree, and by unerring laws guard each, yielding seed and fruit “after his kind,” against deluging storms or desolating drought. Truly, our lines are cast upon a goodly land, whose unrivaled excellence transcends our praises ; and if, gentlemen, we may now no longer, in our imagination or by the light of science, trace those laws which secure for us so benign a present, and for our offspring so glorious a destiny, let us accept them with a reverent trust ; if, for many of us, it is too late to seek to become interpreters of nature, let us, according to our best ability, so teach those who are soon to take our places, her great primal truths—that these, engraft upon their earliest being, may become the germ of other laws to be revealed in the next generation. So much I had hoped to say, in behalf of that College so lately planned for the instruction of our youths in the principles and pursuit of scientific agriculture ; so brief a plea you will excuse when you know that this subject will be presented to you specially by the eloquent and erudite President of that Institution.

It is time that I should give place to him who, by your unanimous nomination and choice, succeeds to the first office in your gift. Yet I may be permitted to say to this son of Oneida, whose practical sagacity, abhorrence of pretense, and freedom from guile, have won such a just appreciation from his fellow citizens, in all his former public relations, that his accession to this new post of honor and duty will be greeted with full acclaim by his brother farmers from every section of the State, and that they, with us, hope great things from the moderation and beneficence of his command. It is not my province, and if it were I am not able or worthy, to cast upon his shoulders the mantle of succession, but let him arise and receive it at the hands of a confiding brotherhood.

REMARKS
OF
BENJAMIN N. HUNTINGTON,
THE
NEWLY ELECTED PRESIDENT,
ON TAKING THE CHAIR.

Gentlemen of the New York State Agricultural Society :

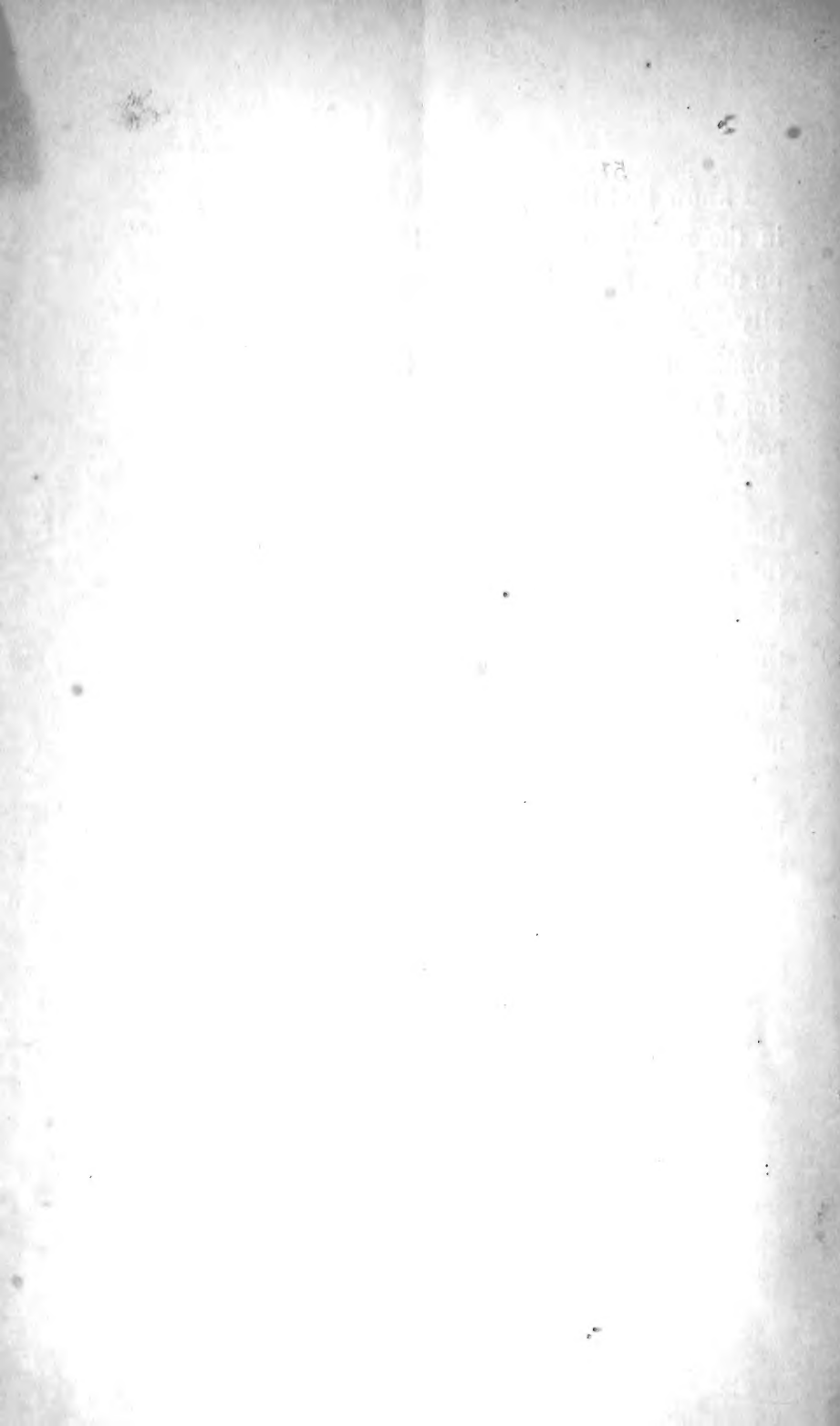
I am sure, while there are very many who can discharge the duties of President of your Society better, that there is no one who can more truly realize the kindness which has prompted you to bestow this honor upon me.

I find it is a pleasant service to assist the Society in its good work of endeavoring to aid the farmer to such culture of the earth as will give him a better reward for his labor, and a happier home. The distinguished gentlemen who have preceded me in this station have left an example of duty, which I shall be glad to imitate to the best of my ability.

I know that those gentlemen associated with me in the management of your Society's affairs will be the most faithful of assistants, and will materially lighten my labors; and while the Corresponding Secretary continues in his present position, I think you will all agree with me that every concern of the Society will be promptly cared for.

You have recommended the place for holding the next Annual Fair, at Elmira; it is a portion of the State where the Society has only once held its exhibition; the enterprise and liberality of that people is well known, and I feel assured that they will show to the State, that agriculture is not neglected in the southern counties of New York.

Gentlemen, I thank you for the honor conferred upon me, and enter on my duties, hoping most of all for your indulgence and friendly assistance.



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